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PERFORMANCE ANALYSIS OF AODV, DSR AND OLSR ROUTING TECHNIQUES FOR AD-HOC MOBILE NETWORKS

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ABSTRACT

Routing is a significant issue in MANETs. In this paper, we have studied the performance of Mobile Ad-hoc network to analyze the impact of AODV, DSR and OLSR routing protocols using OPNET. The applications traffic considered are database and http traffic types and the performance is analyzed using throughput, delay and media access delay parameters.

KEYWORDS: MANET, AODV, DSR, OLSR, OPNET, Simulation

INTRODUCTION

MANET is a collection of interacting mobile platforms or nodes where each node is free to move about arbitrarily. In broad sense, a MANET consists of nodes in an infrastructure-less environment where every node can be seen as logically consisting of a router which could have multiple hosts possessing multiple wireless communication devices.

Routing in adhoc network is a challenging task that plays a pivotal role to route information. Routing protocols are responsible for deciding how the information is going to move through the network. Efficient routing protocols play a vital role in improving throughput of a network. These protocols may be broadly put into three types: proactive, reactive and hybrid. Proactive protocols also known as table-driven routing protocols continuously make routing decisions such that routes are immediately available when packets are needed to be transmitted. Reactive routing protocols on the other hand determine the route as and when needed and hence known as on-demand routing protocols such as AODV [5] and DSR. It works in two stages: (i) route discovery and (ii) route maintenance. Whereas in proactive routing, such as OLSR algorithm, optimizations are done in two ways by reducing (i) size of the control packets and (ii) number of links which are in use for forwarding the link state packets. In this paper, authors have made a humble effort for comparison of performances of

MANETs with different types of routing proto- cols (AODV, DSR and OLSR) are simulated for heterogeneous application traffic types like Database (DB) traffic and HTTP traffic using OPNET network simulator [2].The main objective of this paper to compare various routing protocols (reactive and proactive) for heterogeneous types of traffic.

RELATED WORK

Researchers have developed various routing protocols for MANETs from time to time. The more prominent protocols include- Distance-sequence Distance vector (DSDV) [3], a reactive protocol, Temporally-Ordered Routing algorithm (TORA) [4], a reactive protocol, and Ad-Hoc On-Demand Distance Vector (AODV)[5], a reactive protocol. These protocols have been analyzed taking Random Waypoint Model as the mobility model. Sondi et al. [6] evaluated the performance of a QOS extension of OLSR protocol using the OPNET simulator under different network scenarios. The major traffic considered is voice though in the presence of other traffics as well like file transfer between other users in

the same network. Broch et al. [7] presented performance comparisons of Multi-Hop wireless Ad-Hoc routing protocols, DSDV, TORA, DSR and AODV, with parameters adapted to accurately model the MAC and physical layer behavior of IEEE 802.11 and realistic wireless transmission channel model. Jie and Jia [8] presented OPNET network simulation software's main features including the basic modeling mechanism and simulation step. The experimental result shows that software could accurately analyze network performance and behavior. In [9] authors evaluated the performance of DSR, AODV and DSDV on a framework not limited to the Random Waypoint Model stating that the model can only be applicable to some scenarios. They observed that the protocol performance may vary drastically across mobility and that performance rankings of protocols may vary with the mobility models used. Sharma et al. [10] evaluated the performance of reactive ad-hoc routing protocols using GSM based voice traffic application.

PRESENT WORK

The simulation in the present work is performed using OPNET [2] with simulation parameters as shown below.

Table 1: Simulation Parameters

Routing Protocols	AODV, DSR, OLSR
DATA RATE (bps)	11Mbps
TRANSMIT POWER (W)	0.005
PACKET RECEPTION POWER	-95 dB
BUFFER SIZE(bits)	256000
PCF	DISABLE
MOBILE NODE	50
TRAFFIC TYPE	DataBase (DB) (Medium Load) HTTP (Heavy browsing)
PERFORMANCE PARAMETERS	1)Throughput 2)Delay 3)Media Access Delay
SIMULATION AREA	10*10 km
SIMULATION TIME	600 Sec
SIMULATOR	OPNET MODELER

The performance of MANETs has been analyzed on the basis of following matrices as follows-

Throughput

It is defined as the ratio of the total data that reaches a receiver from the sender. The time it takes by the receiver to receive the last message is called as throughput. It is expressed as bytes or bits per sec (byte/sec or bit/sec).

$$Throughput = \frac{\text{Number of delivered packet} * \text{Packet size} * 8}{\text{total duration of simulation}}$$

A network is desired to deliver maximum throughput.

Delay

The average time it takes a data packet to reach the destination.

Media Access Delay

The time a node takes to access media (link) to start its transmission. For each packet, the delay is recorded when the packet is sent to the physical layer for the first time.

SIMULATION RESULTS

In this section, AODV (reactive), DSR (reactive), and OLSR (Proactive) routing protocols are analyzed using Data Base and HTTP traffic for 50 number of mobile nodes in terms of Throughput, Delay and Media access delay.

Throughput Comparison

Two different cases have been considered to analyze the throughput value. In first case pertaining to DB traffic, the throughput stabilizes in simulation time of 10 min attaining the value of 3.5 Mbps for OLSR, followed by DSR and AODV protocols as shown in figure 1. In second case, pertaining to HTTP traffic, throughput reaches the stabilization point in the same simulation time as for DB traffic i.e. 10 min but the value is slightly less i.e. 2.7Mbps for OLSR followed by DSR and AODV protocols as shown in figure 2.

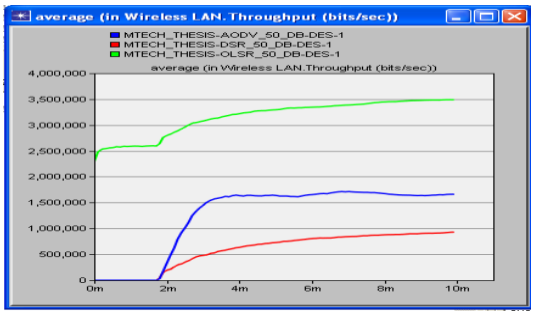

Figure 1: Performance in Term of Throughput for DB Traffic Using Different Routing Protocols (# Nodes=50)

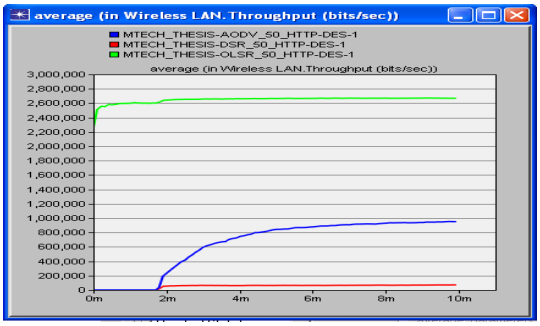

Figure 2: Performance in Term of Throughput for HTTP Traffic Using Different Routing Protocols (# Nodes=50)

Delay Comparison

Here again the comparison has been made between DB traffic and HTTP traffic. It is found that in case of DB traffic, for node size 50, minimum delay comes out to be 0.0010 sec in case of OLSR and maximum delay is 0.0046 sec as shown by DSR in figure 3. In case of HTTP traffic, for node size 50, OLSR gives the minimum delay of 0.0005 sec whereas AODV showed the maximum delay as shown in figure 4.

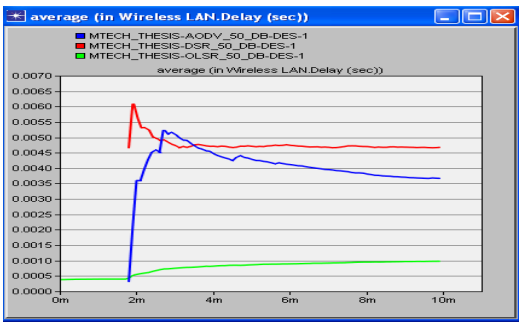

Figure 3: Performance in Term of Delay for DB Traffic Using Different Routing Protocols (#Nodes=50)

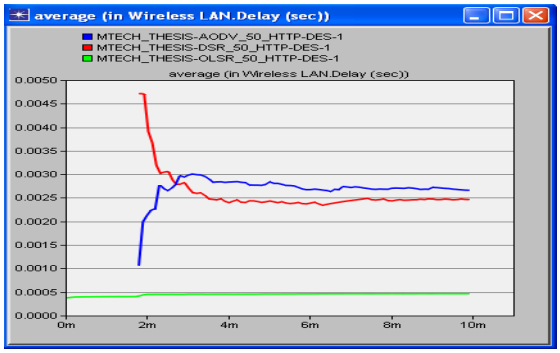

Figure 4: Performance in Term of Delay for HTTP Traffic Using Different Routing Protocols (#Nodes=50)

Media Access Delay Comparison

As per the results shown in figure 5, OLSR shows the minimum media access delay of 0.0021 sec and with the DSR and AODV coming at second and third positions respectively in DB traffic. Also shown in (figure 6) for HTTP Traffic, OLSR have minimum delay .0009 sec and followed by DSR and AODV respectively.

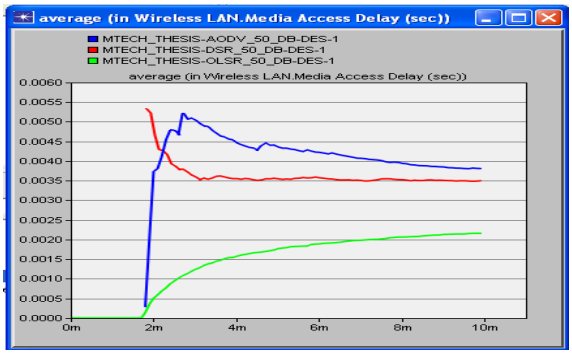

Figure 5: Performance in Term of Media Access Delay for DB Traffic Using Different Routing Protocols (# Nodes=50)

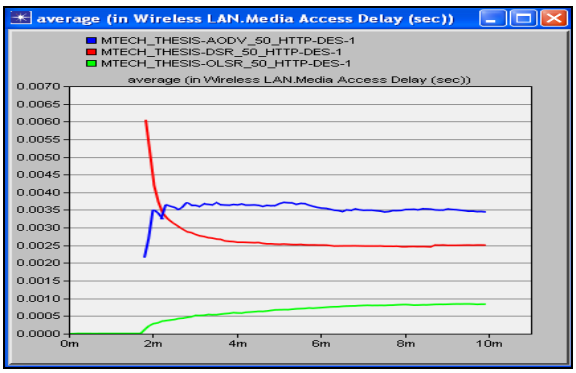

Figure 6: Performance in Term of Media Access Delay for HTTP Traffic Using Different Routing Protocols (# Nodes=50)

Table 2: Overall Performance Comparison Using DB and HTTP Application Traffic

Traffic	Data Base			HTTP		
Routing Protocols	Through-Put (Mbps)	Delay (sec)	Media Access Delay	Through-Put (Mbps)	Delay (sec)	Media Access Delay (sec)
AODV	0.17	0.0037	0.0038	0.95	0.0027	0.0035
DSR	0.9	0.0046	0.0035	0.05	0.0025	0.0025
OLSR	3.5	0.0010	0.0021	2.65	0.0005	0.0009

CONCLUSIONS

In this paper, performance of AODV, DSR, OLSR routing protocols is analyzed with 50 numbers of nodes and two types of application traffics that are Data Base and HTTP. Based upon the results obtained, on the tested scenarios, the broad conclusions are: In case of DB traffic, OLSR has the highest throughput, least delay and least media access delay. In case of HTTP traffic, the proactive OLSR algorithm shows better performance as compared to other protocols such as AODV, DSR. On the basis of these results, OLSR seems to offer better results as compared to AODV and DSR for heterogeneous types of traffic as change of application traffic does not affect its throughput performance much.

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